CLAIMS

1. A method for determining the current distribution of an object by measuring the magnetic fields in the vicinity of the object using a multichannel measurement device that measures an irrotantional and sourceless vector field, whereby one measurement sensor corresponds to each channel, c h a r a c t e r i s e d in that

converting a multi-channel measurement signal corresponding to each measurement sensor into the signals of a predetermined set of virtual sensors; and

determining the current distribution of an object being measured from the signals of the set of virtual sensors in a predetermined function basis to be efficiently calculated.

2. The method as defined in claim 1, c h a r a c t e r i s e d in that the object is approximated using a spherical-harmonic conductor, and a multi-pole development of the field is calculated from the multi-channel measurement signal.

3. The method as defined in claim 2, c h a r a c t e r i s e d in that the multi-pole development is calculated by taking into account the magnetic fields outside the object.

4. The method as defined in claim 2, c h a r a c t e r i s e d in that the multi-pole development is calculated by ignoring the magnetic fields outside the object.

5. The method as defined in claim 2, c h a r a c t e r i s e d in that the external interferences are eliminated using some other known interference eliminating method prior to the conversion.

6. The method as defined in claim 2, c h a r a c t e r i s e d in that as the orthonormal function basis, a current distribution equation of the following form is selected:

$$\vec{J}(\vec{r}) = \sum_{l=0}^{L}\sum_{m=-l}^{l} c_{lm} f(r)\vec{X}lm(\theta,\varphi)\,,$$

wherein *f(r)* is a freely selectable radial function and $\vec{X}lm(\theta,\varphi)$ is so-called vector spherical harmonic.

7. The method as defined in claim 4, c h a r a c t e r i s e d in that

the orthonormal function basis is placed into a current distribution equation; and

the coefficients of the current distribution are analytically solved from the equation:

$$c_{lm} = \hat{\gamma}_l M_{lm}\left[\int_0^R r^l f(r)dr\right]^{-1},$$

wherein γ_l is a constant associated with order 1 and *R* is the radius of the sphere to be examined, and $\vec{X}lm(\theta,\varphi)$ is so-called spherical harmonic.

8. The method as defined in claim 4, c h a r a c t e r i s e d in that function *f(r)* is used to adjust the depth weighing of the current distribution model.

9. A measurement device for determining the current distribution of an object by measuring magnetic fields in the vicinity of the object, the measurement device comprising:

a set of measurement channels (1, 1^1, 1^2, ...1^n) that measure an irrotational and sourceless vector field, in which case at least one measurement sensor 2, 2^1, 2^2,...2^4 corresponds to each channel; and

processing means (3) for processing the measurement signal and in which the object is approximated using a spherical-symmetrical conductor, c h a r a c t e r i s e d in that

the processing means include a conversion module (4) for converting a multi-channel measurement signal corresponding to each measurement sensor into

the signals of a predetermined set of virtual sensors; and

calculation means (5) for determining the current distribution of an object being examined from the set of virtual sensors using depth *r* in a predetermined orthonormal function basis.

10. The measurement device as defined in claim 9, characterised in that the calculation means (5) are arranged to calculate a multipole development from the multi-channel measurement signal.

11. The measurement device as defined in claim 10, characterised in that the multipole development is calculated by taking into account the magnetic fields outside the object being measured.

12. The measurement device as defined in claim 10, characterised in that the multipole development is calculated by ignoring the magnetic fields outside the object being measured.

13. The measurement device as defined in claim 10, characterised in that as the orthonormal function basis, a current distribution equation with the following form is selected:

$$\vec{J}(\vec{r})=\sum_{l=0}^{L}\sum_{m=-l}^{l}c_{lm}f(r)\vec{X}lm(\theta,\varphi),$$

wherein *f(r)* is a radial function to be freely selected.

14. The measurement device as defined in claim 12, characterised in that

the orthonormal function basis is placed into the current distribution equation; and

the coefficients of the current distribution are solved analytically from the equation:

$$c_{lm} = \hat{\gamma}_l M_{lm} \left[\int_0^R r^l f(r) dr \right]^{-1},$$

wherein γ_l is a constant associated with order 1 and R is the radius of the sphere to be examined.

15. The measurement device as defined in claim 13, characterised in that function $f(r)$ is used to adjust the depth weighing of a current distribution model.

16. The measurement device and analysis software as defined in claim 9, wherein the measurement device converts the signals into a set of virtual sensors prior to their storage, and the analysis software converts the stored data into a current distribution.